Oxidative stability of 70% fish oil-in-water emulsions: Impact of emulsifiers and pH

The objective of this study was to evaluate the protective effects of five different emulsifiers on lipid oxidation in 70% fish oil-in-water emulsions to be used as delivery systems for long chain polyunsaturated omega-3 fatty acids to foods. The emulsifiers were either phospholipid (PL)-based or protein-based. The PL-based emulsifiers were soy lecithin and two milk PL concentrates (with either 20 or 75% PL). The protein-based emulsifiers were whey protein isolate and sodium caseinate. Lipid oxidation was studied at two pH values (pH 4.5 and 7.0) and results were compared to lipid oxidation in neat fish oil. Lipid oxidation was followed by determination of peroxide values and volatile oxidation products. Emulsions were furthermore imaged by confocal and cryo-scanning electron microscopy. Results showed that emulsions prepared at high pH with proteins oxidized less than or equally to neat oil, whereas, all other emulsions oxidized more. In addition, there was a tendency toward a faster progression in lipid oxidation at low pH compared to high pH for emulsions prepared with protein-based emulsifiers. The opposite was observed for emulsions prepared with PL-based emulsifiers. Hence, at low pH PL-based emulsions may be more suitable as delivery systems than protein-based emulsions. Moreover, the quality of the PL-based emulsifiers seemed to affect lipid oxidation.

Practical applications: Results from the present study give an insight into the physical and oxidative stability of 70% fish oil-in-water emulsions prepared with whey protein isolate, sodium caseinate, milk phospholipids, or soy lecithin. The emulsions can be used as delivery systems for fish oil to foods. However, only emulsions prepared with proteins at high pH offered advantages with respect to better oxidative stability during storage compared to neat fish oil. Thus, when fish oil is added to a food product in a delivery emulsion, the type of emulsion used should be carefully considered.

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